

A Review of the Genus *Hypenidium* Loew, 1862 (Diptera: Tephritidae)

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Korneyev V. A., Gharali B. & Rakhshani H. A review of the genus *Hypenidium* Loew, 1862 (Diptera: Tephritidae). Summary. The taxonomic position of the genus *Hypenidium* is analyzed and its relationships with other genera of the tribe Noetini are discussed. An illustrated key to species of the genus is provided. Examined material of *H. graecum* Loew, 1862, *H. roborowskii* (Becker, 1908) and *H. oculatum* (Becker, 1913) is listed and their distribution is summarized. Morphological features of all three species are illustrated. Larvae of all species develop solely in flower heads of *Lactuca* spp.

Key words: Diptera, Tephritidae, *Hypenidium*, Palearctic Region, key, distribution, *Lactuca*.

Корнеев В. А., Гарали Б. и Рахшани Х. Обзор рода *Hypenidium* Loew, 1862 (Diptera: Tephritidae). Резюме. Проанализировано систематическое положение рода *Hypenidium*; обсуждаются его отношения с другими родами трибы Noetini. Приведена иллюстрированная таблица для определения видов. Перечислен изученный материал *H. graecum* Loew, 1862, *H. roborowskii* (Becker, 1908) и *H. oculatum* (Becker, 1913) и проанализировано распространение каждого из видов. Даны иллюстрации морфологических особенностей каждого из видов. Личинки всех видов развиваются одиночно в соцветиях *Lactuca* spp.

Ключевые слова: Diptera, Tephritidae, *Hypenidium*, Палеарктика, таблица для определения, распространение, *Lactuca*.

Корнєєв В. О., Гаралі Б. і Рахшані Г. Огляд роду *Hypenidium* Loew, 1862 (Diptera: Tephritidae). Резюме. Проаналізовано систематичне положення роду *Hypenidium*; обговорюються його зв'язки з іншими родами триби Noetini. Наведено ілюстрований ключ для визначення видів. Перераховано вивчений матеріал *H. graecum* Loew, 1862, *H. roborowskii* (Becker, 1908) і *H. oculatum* (Becker, 1913) та проаналізовано поширення кожного з видів. Наведено ілюстрації морфологічних особливостей кожного з видів. Личинки всіх видів розвиваються поодинокі у суцвіттях *Lactuca* spp.

Ключевые слова: Diptera, Tephritidae, *Hypenidium*, Палеарктика, ключ для визначення, поширення, *Lactuca*.

Introduction

The genus *Hypenidium* was originally described as monotypic (Loew, 1862), with *H. graecum* Loew, 1862 included. Later, several species were added to it, and the taxonomic

position was reconsidered several times. Based on its aberrant external characters, Hendel (1927) assigned it, along with *Trigonochorium* Becker, 1913, to the tribe Euribiini (=Myopitini), and since the concept of this tribe was reconsidered, Freidberg & Kugler (1989) placed this genus to Trypetini.

Detailed studies of genitalic characters and host plant relationships, however, showed close relationships of *Hypenidium* to a group of closely related genera *Noeeta* Robineau-Desvoidy, 1830, *Acidogona* Loew, 1873, *Paracanthella* Hendel, 1927, and *Jamesomyia* Quisenberry, 1949. All of them share the barbed, spear-like aculeus (Korneyev, 1999: Fig. 22.4) and simplified phallus glans with elongate tubular acrophallus.

All of these genera, plus *Ensina* Robineau-Desvoidy, 1830, *Xenochaeta* Snow, 1894, and *Trigonochorium*, were included in the tribe Noetini Norrbom & Korneyev. Originally, it was mentioned by Wang (1998) with the reference to the World Catalogue and Database of Tephritidae (Norrbom et al., 1999), prior to its publication. As the tribal name was published with a short diagnosis and explicit credits to its authorship, this tribe name should be cited as Noetini Norrbom & Korneyev in: Wang, 1998, according to article 50.1.1 of the Code of Zoological Nomenclature (ICZN, 1999).

Later, Korneyev (1999) briefly analyzed phylogenetic relationships in the Noetini and showed that all the three species now assigned to *Hypenidium*, form a separate monophyletic lineage in the tribe. They share connection to *Lactuca* host plants, like most other noetines (except a Holarctic lineage *Noeeta*+*Acidogona*, feeding in *Hieracium* flower heads). He (Korneyev, 1999) included *Trigonochorium oculatum* Becker in the genus *Hypenidium*, but the two genera names have not been formally synonymized. Recently, Norrbom (Norrbom et al. 2010) showed *Xenochaeta* to be a junior subjective synonym of *Acidogona*. Analysis of phylogenetic relationships based on 16S mitochondrial rDNA sequences (Han, Ro & McPherson, 2006) revealed that *Ensina* may not be related to Noetini at all, and the barbed aculeus, the only character it shares with the other genera of the tribe could be a homoplasy.

As a result, the tribe Noetini now includes the genera *Noeeta*, *Hypenidium*, *Acidogona*, *Paracanthella*, and *Jamesomyia*. The position of *Ensina* remains uncertain.

Monophyly of *Hypenidium* is supported by having the vertically elongate compound eyes, somewhat reduced chaetotaxy of the head (one (rarely two) orbital seta present), banded or dimidiate wing pattern without rounded hyaline spots or dots, bare vein R_{4+5} , very short, almost inconspicuous posteroapical lobe of the basal (posterior) cubital cell (bcu, cup) (apomorphies) in combination with rounded epandrium bearing short surstyli (plesiomorphy, shared with Nearctic *Jamesomyia*), and by the association with *Lactuca* (also in *Jamesomyia* and *Paracanthella*).

Species of *Hypenidium* occur along the ancient Mediterranean area, from Portugal and Morocco to the west of China and the Middle East. Specimens are not abundant in collections, and little is known about their distribution and bionomics.

During intensive studies of the fruit flies in Iran during the last decade, some new interesting data on the distribution of *Hypenidium* species were accumulated, along with data on their morphology, and here we briefly summarize them.

Material and Methods

Acronyms for the institutions where specimens are deposited are:

BGC	Babak Gharali private collection, Iran;
MHNG	Muséum d'histoire naturelle, Genève, Switzerland;
NMP	National Museum Prague, Kunratice, Czech Republic;
RBINH	Royal Belgian Institute of Natural History, Brussels, Belgium;
SIZK	I.I.Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine, Kiev, Ukraine;
ZISP	Zoological Institute of Russian Academy of Sciences, St. Petersburg, Russia;
ZMHB	Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin, Germany.

Label data for all examined specimens are cited literally as they appear on the labels of type specimens, with line breaks marked with a forward slash ("/"). Labels of non-type specimens written in the Cyrillic alphabet are translated or transliterated.

Hypenidium Loew, 1862

Type species: *Hypenidium graecum* Loew, 1862 (by monotypy).

Loew, 1862: 87; Hendel, 1927: 33; Foote, 1984: 94; Freidberg & Kugler, 1989: 191; Norrbom et al., 1999: 191.

Trigonochorium Becker, 1913.

Type-species: *Trigonochorium oculatum* Becker, 1913 (by monotypy). Becker, 1913: 647; Hendel, 1927: 36; Foote, 1984: 136; Norrbom et al., 1999: 228.

Type species: *Trigonochorium oculatum* Becker, 1913.

Stephanaciura Ségué, 1930.

Type-species: *Stephanaciura bipartita* Seguy, 1930 (by original designation).

Ségué, 1930: 171; Foote, 1984: 94; Norrbom et al., 1999: 161.

Diagnosis. Moderately small or medium-sized (3.0–5.5 mm) flies with shining brown yellow or black body, brown or dark yellow banded or dimidiate wing pattern, vertical oval eyes, one orbital seta (in some specimens with additional second seta), uniformly coloured (dark yellow or black acuminate, without thickened white) postocular setae, cell bcu (=cup) with inconspicuous lobe, round epandrium with short surstyli, narrow phallus glans with elongate tubular acrophallus, short and densely trichose ventral side of oviscape, and rather narrow, apically barbed aculeus. Larvae in flower heads of lettuce (*Lactuca*).

Key to species of *Hypenidium*

- Discomedial cell (dm) apically with a triangular hyaline area (Fig. 1); vein r-m closer to base of dm. Mesonotum and abdomen orange yellow, often with brownish pattern. Iran. *oculatum*
- Discomedial cell (dm) entirely brown or black, without hyaline area; vein r-m closer to apex of dm (Figs. 2, 3). 2.
- Cell r_{4+5} entirely dark without hyaline area (Fig. 2); mesonotal scutum and abdomen shining black with black setulae only (Fig. 6). Gena and parafacial with strong and dense black setulae, some almost as long as genal seta; male proboscis with long, slightly curled setae on posterior portion of labellum and on prementum (Fig. 5). Female with aculeus apex barbed and laterally serrate (Figs. 9, 34). Mediterranean Region from Portugal and Morocco to Ukraine (Crimea), Greece and Israel; ?Turkey. *graecum*
- Cell r_{4+5} with hyaline area basally (Fig. 3); mesonotal scutum and abdomen with mixed yellow and black setulae. Gena and parafacial with short and sparse black setulae much shorter than genal seta. Male proboscis with normal, short setae only. Female with aculeus apex barbed, with smooth margins (Figs. 25, 39). Middle East, from Armenia and Syria to W China. *roborowskii*

Hypenidium graecum Loew, 1862 (Figs. 2, 4–10, 27–36)

Loew, 1862: 87; Hendel, 1927: 34; Richter, 1965: 142; 1970: 138; Foote & Freidberg, 1981: 31; Foote, 1984: 94; Freidberg & Kugler, 1989: 192; Merz, 1994: 104; Norrbom et al., 1999: 161; Korneyev, 1999: 565. — *novakii* Strobl, 1893: 124 (*Hemilea*); Foote, 1984: 94; Foote & Freidberg, 1981: 31; Norrbom et al., 1999: 161; — *novaki* Hendel, 1927: 34; Mihalyi, 1960: 12; Richter, 1960: 893; Richter, 1970: 138; Kugler & Freidberg, 1976: 57. — *pulchella* Tavares 1902:131; Norrbom et al., 1999: 161 (*Acidia*); — *bipartita* Seguy, 1930: 171; Foote & Freidberg, 1980: 31 (*Stephanaciura*).

Material examined. Type. Holotype ♂ *Hyphenidium graecum*: Greece: "Parnass / Krüper", "2793", "biramosa" (ZMHB). **Non-type.** Spain: "Spanien / 54534", 1 ♂ ("Hyphenidium novaki Strobl") (ZMHB); Greece: "Parnass / 11/5 66", "coll. / H. Loew", 1 ♂; "Parnass", "Griechland / 50848", 1 ♂ ("Hyphenidium novaki Strobl") (ZMHB); **Ukraine:** Crimea, Yalta, 6.09.1923, 1 ♀ [S. Paramonov leg.?] (SIZK); **Israel,** Nataf, 26.10.1992, 2 ♂; Mt. Meiron, 30.09.1982, 1 ♀ (A. Freidberg) (SIZK).

Distribution. Portugal, Spain, France, Italy, Bosnia, Greece, Ukraine (Crimean Peninsula), Morocco, Israel.

Biology. Larvae of *H. graecum* were reported to develop singly in swollen flower buds of *Lactuca viminea* L. in Portugal (Tavares, 1902 (as *Acidia pulchella*); Houard, 1909: 1048 (as *Acidia pulchella*); Mihalyi, 1960; Freidberg & Kugler, 1989).

Remarks. *H. graecum* was redescribed in detail by Hendel (1927) and Freidberg & Kugler (1989), and we do not repeat its description here. It clearly differs from other species of the genus by the setulae on the mesonotum and abdomen uniformly black or brown (partly yellowish white in *H. roborowskii* and *H. oculatum*) and cell r_{4+5} usually entirely brown, without hyaline spots. The mesonotum (except the postpronotal lobe and scutellum) (Fig. 6) and the abdomen shining black (yellow with red or brown pattern in other species, except the melanistic specimens of *H. roborowskii*, which have the same coloration of the body), entirely covered with black or dark brown setulae. Male genitalia: the epandrium (Figs. 27–28) round, with numerous setae; the surstyli very short, with 2 prensisetae; the phallus thin, with small glans (Fig. 31) bearing narrowly conic epiphallus; the basiphallus slightly produced posteriorly (Fig. 29); the phallapodeme (Fig. 30) with two symmetrical, well sclerotized vanes. Female terminalia: the oviscape densely setulose in the apical two-thirds; eversible membrane dorsally with two long subparallel taeniae and a pouch in its distal part covered with minute triangular scales (Fig. 32), ventrally with tooth-like enlarged scales (Fig. 7,

33); the aculeus as on Figs. 8–9 and 33–35, its apical portion (Figs. 9, 34) with serrate margin (smooth in *H. roborowskii* and *H. oculatum*); the spermatheca (Figs. 10, 36) with moderately developed papillae (with sparse and small papillae in *H. roborowskii* and *H. oculatum*).

Hyphenidium roborowskii (Becker, 1908) (Figs. 3, 11–26, 37–40)

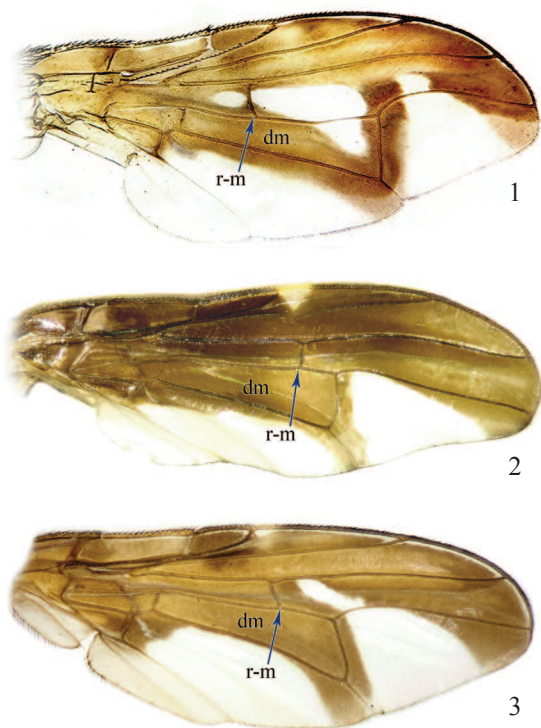
Becker, 1908: 290 (*Hemilea*); Hendel, 1927: 166; Richter, 1965: 142; 1970: 138; Foote, 1984: 94; Wang, 1998: 229; Norrbom et al., 1999: 161; Korneyev, 1999: 565; Korneyev & Dirlbek, 2001: 468; Gilasian & Merz, 2008: 12; Mohamadzade, Nozari & Rasouljan, 2010: 29 (*Hyphenidium*).

Material examined. Type. Holotype ♀: China: «р. Бугас Ю Хами, Гашунское Гоби ЮВ Тянь-Шаня, 10.IX.95 Руб. [орловский] Козлов» [Bugas River S of Khami, Gashun Gobi NE Tian Shan, Roborowski & Kozlov leg.] (ZISP). **Non-type.** Syria: Suchne, 20–25.4.1960, Meyadin, 15–18.05.1960, 5 ♂ (M. avi) (NMP); **Jordan:** Aljun Irbid, 29.05.1968, 1 ♂ (M. Malkavi) (NMP); **Iraq:** Samarra, 06.1965, 1 ♂ (A. Moussli) (NMP); **Armenia:** Erivan, 8.09.1962, 5 ♂, 1 ♀ (V. Richter) (ZISP); **Azerbaijan:** Naxçıvan, "Djulfā" [=Culfa] vicinity, 28.05.1974, 1 ♂ (M. Volkovich); Ordubad vicinity, 30.05.1974, 1 ♂ (M. Volkovich) (ZISP); **Kazakhstan:** Karatau Mts., Glinkovo 30 km SE Leontyevo, 6.05.1994 (V. Korneyev); Chundzha, 24.07.1990, 1 ♂ (M. Nesterov) (SIZK); **Turkmenistan:** Kopetdagh, Kara-Kala, 7.08.1934, ♂, 9.08.1934, ♂ (V. Popov); idem, 8.08.1952, 1 ♂ (K. Borisova); Kopetdagh, Yarty-Kala on Chandyr River, 17.08.1934, 1 ♂ (V. Popov) (ZISP); **Uzbekistan:** "Buqara, Yargak, prope Khatyrchi", 3, 4, 8, 28.08.1928, 1 ♂, 3 ♀ (L. Zimin), Guzar, 12.04.1929, 1 ♂ (L. Zimin) (*H. roborowskii* L. Zimin det.); vicinity of Guzar, 4.09.1929, 1 ♂ [L. Zimin]; "st[ani]tsa Vrevskaya" Tashkent Distr., "Kochachek" 31.08.1932, 1 ♂; Samarkand, "ex seed heads of *Lactuca altissima*", 17.08.1973, 1 ♂ (collector?) (*Hyphenidium roborowskii* V. Richter det.) (ZISP); **Kyrgyzstan:** Kara-Artscha Tal, 35 km ESE Dzhambul, 4.05.1994, 1 ♀ (B. Merz) (MHNG); Boom Ravine, 42°35.9'N 75°47.4'E, 1450–1800 m, 31.06.1998, 1 ♂ (V. Korneyev & E. Kameneva); Kassan-Sai River valley, 22.1 km N of Jangy-Bazar, 41°29.7'N 70°58.2'E, 1850 m, 2.07.1998, 1 ♀ (V. Korneyev & E. Kameneva); Karaty, 10.6 km N of Tashkumyr, 41°26.3'N 72°13.4'E, 800–950 m, 3.07.1998, 1 ♂ (V. Korneyev & E. Kameneva); Surmetash River, Egin-Jay, 39°50.6'N 72°05.2'E, 1900 m, 6–7.07.1998, 2 ♂ (V. Korneyev & E. Kameneva) (SIZK); "Mikhailovka", Kugart River valley, Ferghana Mt. Range, 15.05.1925, 1 ♂ (Th. Dobzhansky) (ZISP); **Tadzhikistan:** Khodja-obi-Garm, 12.08.1944, 2 ♂, 1 ♀ (M. Nikolskaja); idem, S slope of Ghissar Range, 3.09.1946, 1 ♀ (Rudolf); Dushanbe, 1.06.1934, 1 ♂ (Gussakovsky); Varzob valley, Kondara Canyon, 1100 m, 21.09.1937, 1 ♂ (Gussakovsky); vicinity of Kulyab, 9.07.1939, 1 ♂ (collector?); Karategin Range, Komarou Gorge, 15–16.07.1975, 1 ♂ (M. Volkovitsh) (ZISP); Dushanbe vicinity, 5.08.1985, 1 ♂, 1 ♀ (M. Nesterov) (SIZK); **Iran:** Keredj [=Karaj], 40 km, idem., 60 km, Nissa, Elburs [=Elburz] mts., 12.04, 15.04, 20.04, 30.05, 7.06.1936, 5 ♂, 3 ♀ (Brandt) (RBINH). Iran: Azarbaijan-e-Sharghi province, khosroshahr, 1346m, N 37°38'28" & E 46°02' 55", Malaise trap, 8–21.09.2008, 8 ♂, 6 ♀ (H. Lotfalizadeh) (BGC).

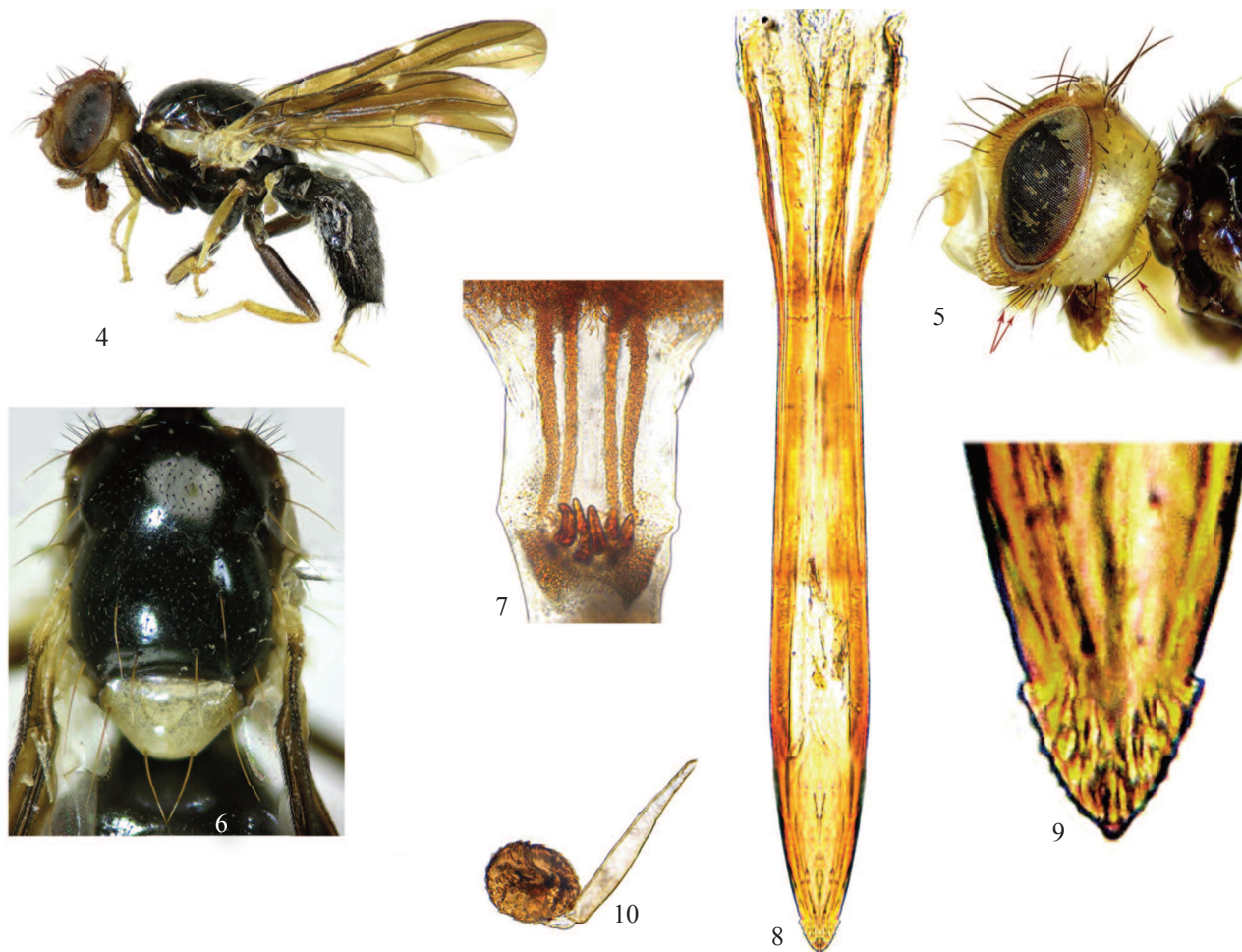
Host plant. *Lactuca* sp. (Mohamadzade, Nozar & Rasouljan, 2010). The record of "*Lactuca altissima*" (= *L. quercina*), on the label (see above), is apparently based on plant misidentification; that species does not occur in Uzbekistan. Puparium brown, similar to that in *Noeeta* spp.

Distribution. Azerbaijan, Syria, Jordan, Iraq, Iran, Turkmenistan, Kazakhstan, Kyrgyzstan, Uzbekistan, western China.

Remarks. This species was described by Becker (1908); Hendel (1927) copied the description, and we do not repeat it here. *H. roborowskii* clearly differs from other species of the genus by the wing pattern (cell r_{4+5} at base with one hyaline spot connected to a large hyaline area in the medial cell. Coloration of the mesonotal scutum varies from entirely reddish yellow (Fig. 13) through reddish yellow with one or two pairs of brown vittae (Figs. 14–15) to entirely black, like in



Figs. 1–3. *Hyphenidium* Loew, wing. 1 — *H. oculatum*; 2 — *H. graecum*; 3 — *H. roborowskii*. dm — discoidal cell; r-m — r-m crossvein.



Figs. 4–10. *H. graecum* Loew. 4 — ♀ (Israel), total view, left; 5 — ♂, head, left (arrows show long setulae on gena and proboscis); 6 — ♀ (Israel), mesonotum, dorsally; 7 — eversible membrane of ovipositor, ventrally; 8 — aculeus apex, ventrally; 9 — aculeus apex, ventrally, enlarged; 10 — spermatheca (one of the two).

H. graecum (Fig. 16). Similarly, abdomen coloration varies from mostly yellow (Fig. 18) or yellow-brown (Fig. 19) to entirely black (Fig. 20). Male genitalia: epandrium (Fig. 21) round, with numerous setae; surstyli very short, with 2 prenisetae; phallus thin, with small glans (Fig. 22, 37) bearing narrowly conic epiphallus; other structures as described for *H. graecum*. Female terminalia: oviscape densely setulose in apical two-thirds (Fig. 23); aculeus as on Figs. 24, 38, apical portion (Figs. 25, 39) with smooth margin (serrate in *H. graecum* and similarly smooth in *H. oculatum*); spermatheca (Figs. 26, 40) with small and sparse papillae (with moderately large and dense papillae in *H. graecum*).

Hyphenidium oculatum (Becker, 1913) (Figs. 1, 41–48)

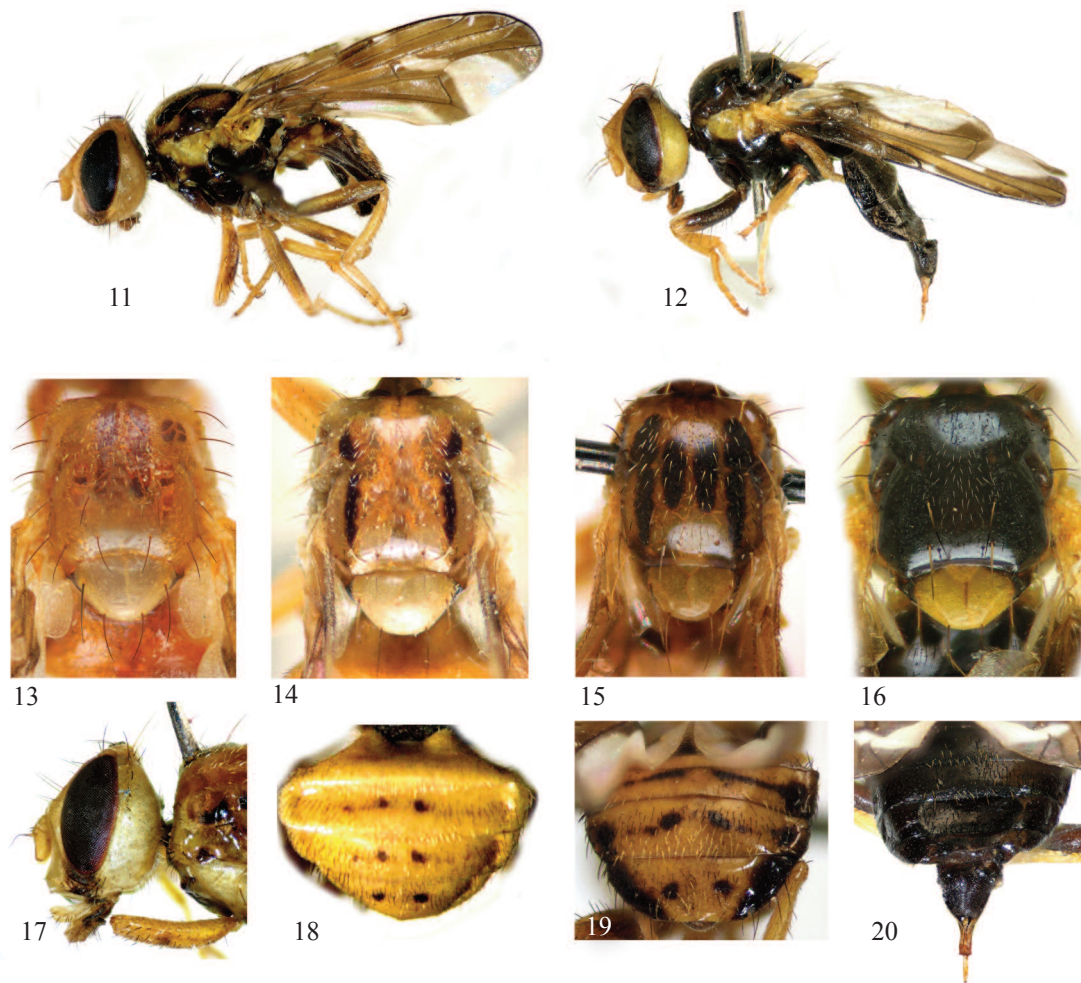
Becker, 1913: 647; Hendel, 1927: 36; Foote, 1984: 136; Norrbom et al., 1999: 229 (*Trigonochorium*); Korneyev, 1999: 565 (*Hyphenidium*).

Material examined. Type. Holotype ♂: S: “Дех-и-Пабид, ур<очище> Хазык, Саргад Кирман, 18/20.VIII.98, Экспед. в Персию Зарудный [Beludshistan, Kirman, between Dech-i-Pabid and Chasyk, 18–20.8.1898 (Zarudny)]” (ZISP). **Non-type.** S: Mian Jangal (loc. nr 223), 30.05–5.06.1973, 2 ♂, 1 ♀ (NMP); Isfahan, faculty of agriculture, 20.05.2008, 1 ♂, 3 ♀ (H. Rakhshani leg.) (BGC)

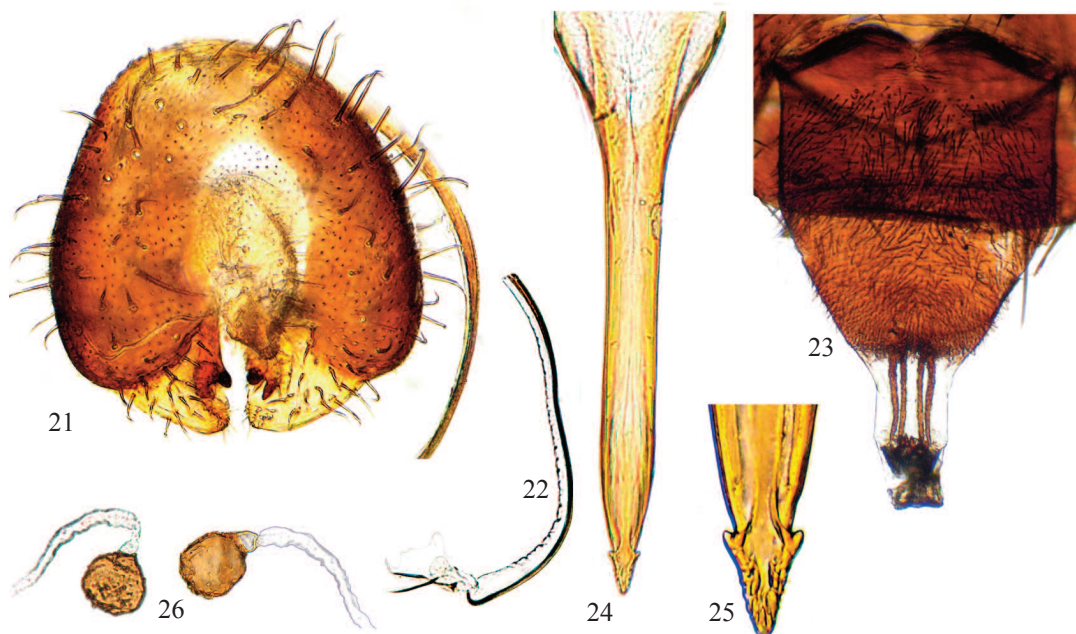
Distribution. Iran (Baluchistan, Isfahan).

Host plant. *Lactuca* sp. (new record).

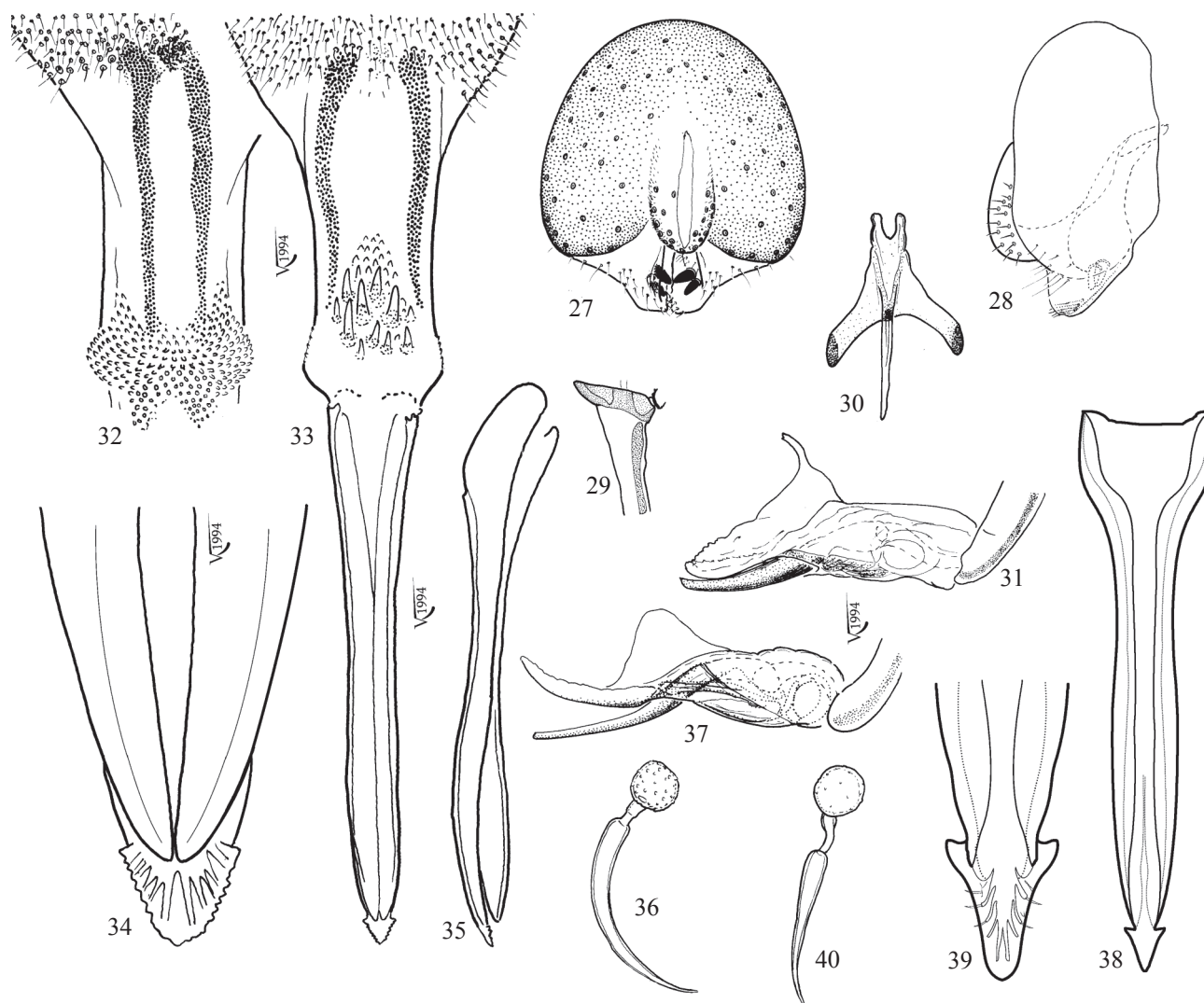
Remarks. *H. oculatum* shares its mainly yellow body coloration and shape of the aculeus apex and spermathecae with *H. roborowskii*, differing mainly in a highly modified venation of the wing, with the vein dm-cu dislocated more apically, almost level with the apex of R_{2+3} and the wing pattern with a large hyaline triangle inside the brown pattern (Fig. 1). Mesonotum reddish yellow with reddish or dark brown vittae, dark yellow setae and black and yellowish-white setulae (Fig. 43). Abdomen (Figs. 44–45) reddish yellow with paired brown marks, covered with yellowish-white setulae. Contrary to *H. roborowskii*, no dark or melanistic specimens are known. Male genitalia: epandrium and hypandrium not examined; phallus (Fig. 46) as described for *H. roborowskii*. Female genitalia: oviscape densely setulose, eversible membrane not examined. Aculeus as in *H. roborowskii*, its apex with smooth lateral margins, as in Fig. 47; 2 spermathecae (Fig. 48) with small and sparse papillae, as in *H. roborowskii*.



Figs. 11–20. *H. roborowskii* Becker. 11 — ♂, total view, left; 12 — ♀, same; 13–16 — mesonotum, dorsally, variants of coloration; 17 — ♂, head, left; 18–20 — abdomen, dorsally, variants of coloration (18–19 — ♂; 20 — ♀).



Figs. 21–26. *H. roborowskii* Becker, ♂ (21–22) and ♀ (23–26) terminalia. 21 — epandrium, posterior view; 22 — phallus, apical portion; 23 — oviscape and eversible membrane, ventrally; 24 — aculeus, ventrally; 25 — aculeus apex, ventrally, enlarged; 26 — spermathecae.



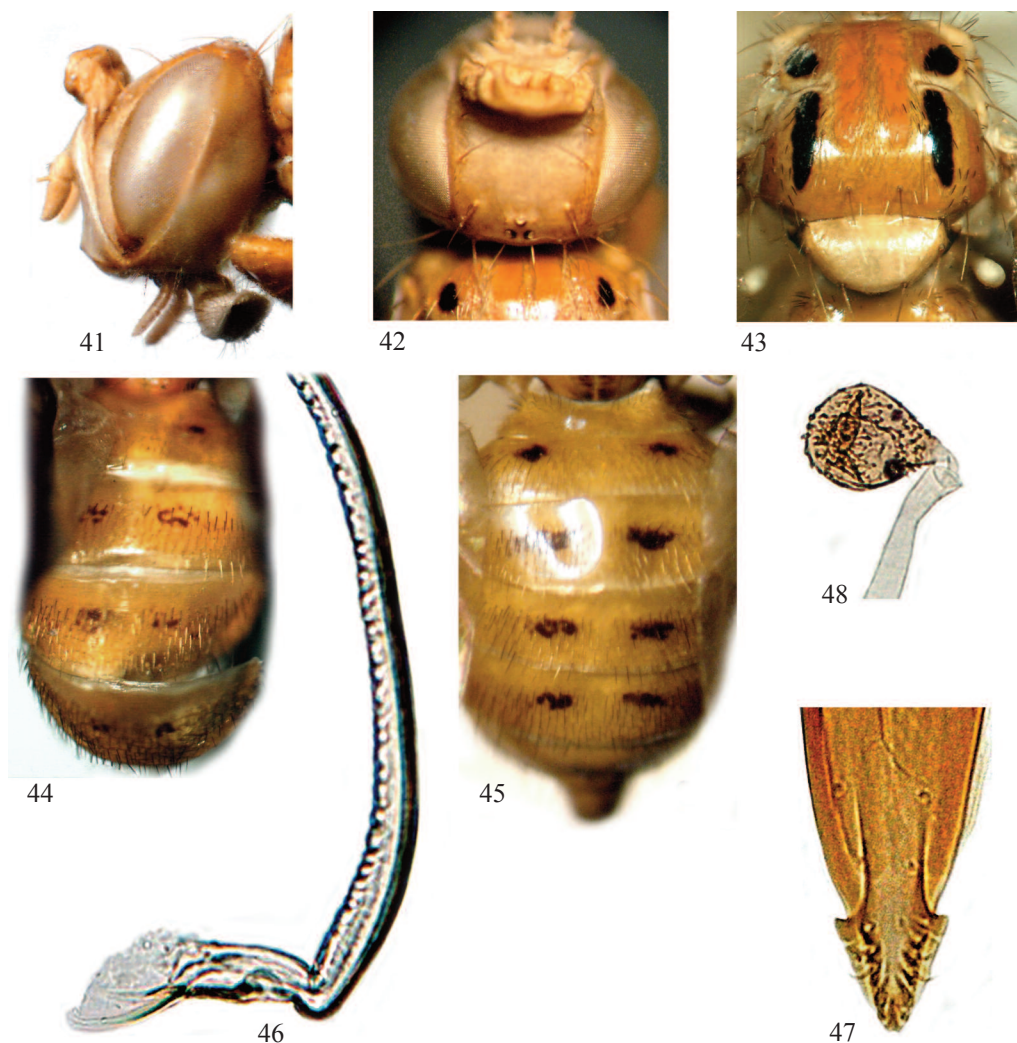
Figs. 27–40. *H. graecum* Loew (27–36) and *H. roborowskii* Becker (37–40), ♂ (27–31, 37) and ♀ (32–36, 38–40) terminalia. 27 — epandrium, posterior view; 28 — same, laterally; 29 — basiphallus, lateral view; 30 — phallodeme, ventrally; 31, 37 — glans of phallus, laterally; 32 — eversible membrane of ovipositor, dorsally; 33 — eversible membrane and aculeus, ventrally; 34, 39 — aculeus apex, ventrally, enlarged; 35 — aculeus, laterally; 36, 40 — spermathecae; 38 — aculeus ventrally.

Discussion

The genus *Hypenidium* is represented by the three species, each with separate distribution ranges, which possibly overlap in the Middle East. The distribution of *H. graecum* covers mostly the northern Mediterranean Region, reaching Morocco in the South-West, Crimea in the North-East, and Israel in the South-East. It is not clear if *H. graecum* also occurs in Turkey and North-Eastern Iran; a few black specimens from this area were melanistic *H. roborowskii*; some specimens seen as photographs, but not examined, can be either *H. graecum* or a melanistic morph of *H. roborowskii*. The latter species is widespread from the Near East (Syria, Jordan, Iraq) through northern Iran and Middle Asia to western China. *H. oculatum*, hitherto known only from the holotype collected in Baluchistan, here is recorded also from Central Iran.

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Figs. 41–48. *H. oculatum* Becker. 41 — head, left; 42 — head, dorsally; 43 — mesonotum, dorsally; 44–45 — abdomen (44 — ♂, 45 — ♀); 46 — phallus, apical portion; 47 — aculeus apex, ventrally; 48 — spermatheca.

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